
Longevity Testing of QuinTron Sample Holding Bags with Patient Breath Samples

Abstract

If long-term storage is needed, QuinTron recommends storing dried patient breath samples in sample holding bags (QT00842-P). Samples can be stored in these bags for up to two weeks without significant losses in H₂, CH₄ and CO₂ concentration.

Introduction

When bacteria digest (or ferment) food substances, they produce acids, water and gases. The major gases produced by bacteria include, primarily, hydrogen (H₂), methane (CH₄), carbon dioxide (CO₂) and small concentrations of aromatic gases.¹ These gases are absorbed into the blood circulating near the site of digestion and are carried to lungs, where they are equilibrated with the air in the alveoli. When a patient exhales, gases contained in alveolar air can be captured and measured.

QuinTron manufactures instruments and accessories which are designed to capture and analyze the contents of a patient's breath sample. Specifically, our instrumentation measures concentrations of breath hydrogen (H₂) and methane (CH₄) in parts per million (ppm) and the percentage of exhaled carbon dioxide (CO₂). In the GaSampler collection system, patients exhale into a collection bag (QT00844-P, QT00834-P, QT00841-P, or QT00830-P) which holds the alveolar air sample until it is ready to be analyzed. Samples in the collection bags must be analyzed within a matter of hours. If this is not possible, the sample should be transferred to a sample holding bag for long-term storage.

QuinTron sample holding bags (QT00842-P) are made of a proprietary aluminum foil-laminate. Hydrogen, being the smallest element, can easily diffuse through many materials; one exception to this being metal foils due to their low permeability rating. The purpose of this study was to determine how long the sample holding bags could adequately hold a sample without significant losses in H₂, CH₄ and CO₂ concentration.

Materials/Method

Alveolar air samples were collected in a 750mL sample collection bag (QT00841-P) using the GaSampler system from five volunteers (D1-D5). Volunteers in this study were not required to fast and did not ingest a sugar or substrate. The samples were transferred into individual holding bags through a patient sample drying tube (QT01135-K). QuinTron Application Note #3 emphasizes drying a patient's breath sample if long-term storage is required. The H₂, CH₄ and CO₂ concentrations of each sample were measured on a BreathTracker SC every week for five weeks.

Results

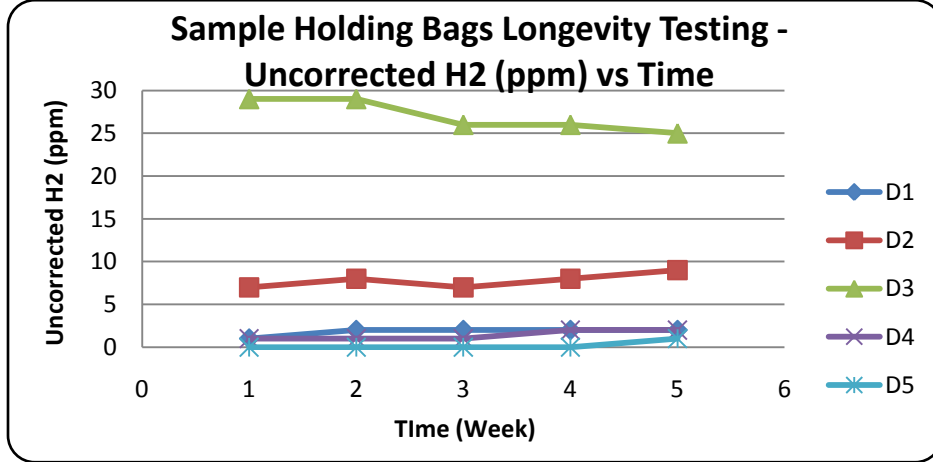
Table 1 shows each volunteer's sample (marked with identifier D1-D5), the week each sample was measured and the uncorrected and corrected H₂, CH₄ and CO₂ concentrations for that week. The right side of the table (Corrected Data) shows the H₂ and CH₄ concentrations corrected for dilutions along with the CO₂ correction factor (see the BreathTracker SC manual for an explanation of the CO₂ Correction Factor). The concentration of CO₂ was measured each time to confirm the validity of each sample.

Table 1: Uncorrected and Corrected Gas Concentrations of Each Sample Measured Week-by-Week

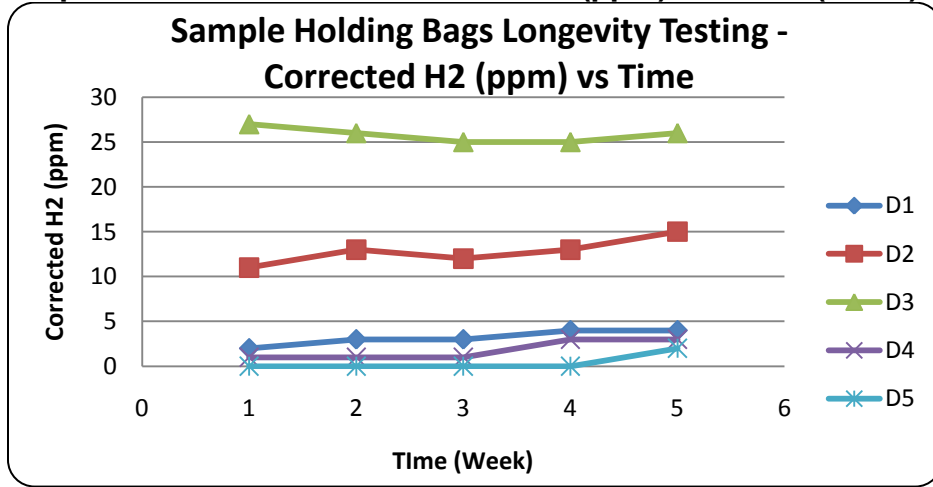
Identifier	Week	UNCORRECTED DATA			CORRECTED DATA		
		H2 (ppm)	CH4 (ppm)	CO2 (%)	H2 (ppm)	CH4 (ppm)	CO2 Corr Factor
D1	1	1	0	3.4	2	0	1.62
	2	2	0	3.6	3	0	1.53
	3	2	0	3.2	3	0	1.72
	4	2	0	3	4	0	1.83
	5	2	0	2.9	4	0	1.9
D2	1	7	0	3.4	11	0	1.62
	2	8	2	3.5	13	3	1.57
	3	7	0	3.3	12	0	1.67
	4	8	0	3.3	13	0	1.67
	5	9	0	3.3	15	0	1.67
D3	1	29	0	5.9	27	0	0.93
	2	29	0	6.1	26	0	0.9
	3	26	0	5.7	25	0	0.96
	4	26	2	5.8	25	2	0.95
	5	25	3	5.4	26	3	1.01
D4	1	1	35	4.5	1	43	1.22
	2	1	34	4.5	1	41	1.22
	3	1	27	4.1	1	36	1.34
	4	2	27	4.1	3	36	1.34
	5	2	25	3.8	3	36	1.45
D5	1	0	0	3.9	0	0	1.41
	2	0	0	3.9	0	0	1.41
	3	0	0	3.6	0	0	1.53
	4	0	0	3.7	0	0	1.49
	5	1	0	3.6	2	0	1.53

Graphs 1-4 show the uncorrected and corrected data broken down by individual gas.

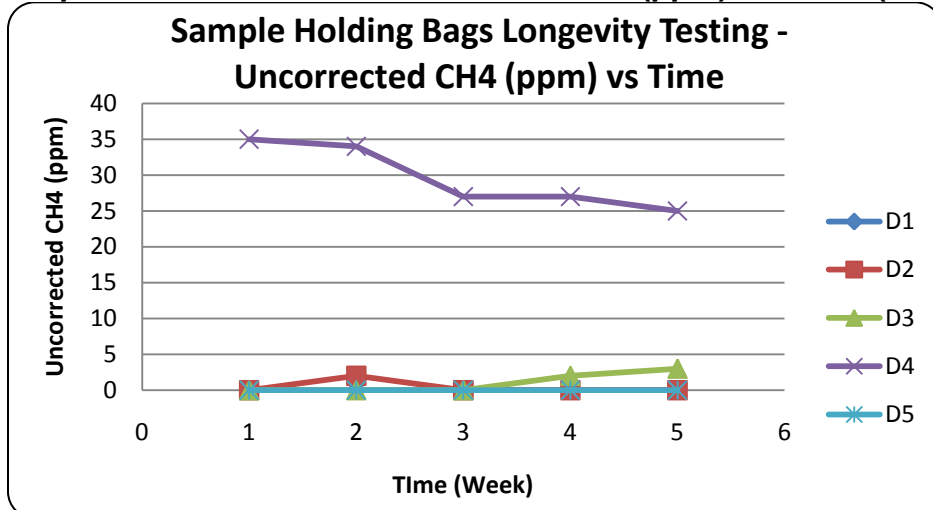
Graph 1: Uncorrected H₂ Concentration (ppm) vs. Time (Week)



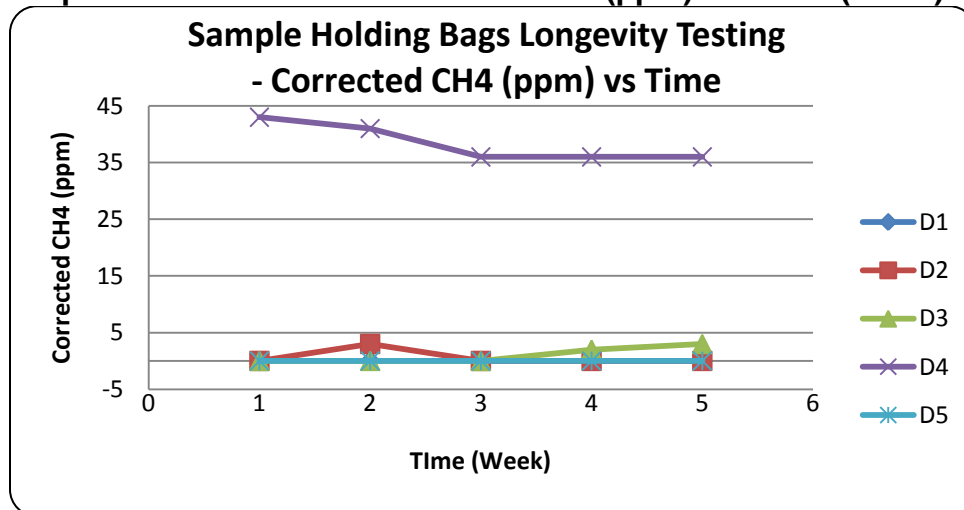
Graph 2: Corrected H₂ Concentration (ppm) vs. Time (Week)



Graph 3: Uncorrected CH₄ Concentration (ppm) vs. Time (Week)



Graph 4: Corrected CH₄ Concentration (ppm) vs. Time (Week)



Over the course of five weeks, one volunteer’s sample (D4) showed a steady decrease in CH₄ concentration. However, the H₂ concentration remained constant for three weeks before increasing slightly. The other four volunteers’ samples showed consistent readings for both H₂ and CH₄ up until the last two weeks when sudden slight increases in H₂ (D4 and D5) and CH₄ (D3) were observed. Despite the decrease in CH₄ concentration in D4’s sample, no other significant losses, particularly in H₂ concentration occurred. After two weeks it was noted that the CO₂ concentration began to decrease in all five samples. This confirms that the sample holding bags can store patient breath samples for long periods of time with minimal losses in gas concentration.

Conclusion

At three weeks the H₂ and CH₄ concentrations appear to remain constant but the CO₂ concentration begins to decrease slightly over time. To maintain the sample integrity, QuinTron recommends a maximum holding time of no more than two weeks for dry patient breath samples in the sample holding bags.

For further information on the history and science of breath-testing, sample protocols and collection techniques please reference Breath-Tests & Gastroenterology, 1998 edition, written by Lyle Hamilton Ph.D. or request information from QuinTron directly.

References

1. Bond, J.H., Levitt, M.D. Quantitative measurement of lactose absorption. *Gastroenterol.* 1976; 70(6):1058-62